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Enhancing Paraphrase Evaluation in Marathi Question Answering Systems Using Similarity Techniques

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ABSTRACT

In Natural Language Processing applications, paraphrasing is essential, especially in Question Answering (QA) systems where users may provide distinct yet valid responses to the same questions. This study presents a structured approach for evaluating paraphrased answers in the Marathi language using multiple similarity measures, including Levenshtein Distance, Jaccard Similarity, and Cosine Similarity. The proposed methodology integrates one-to-one word matching, masking techniques, synonym dictionary verification, and dependency parsing to ensure grammatical and syntactic consistency. A dataset comprising 540 questions from the Balbharti Standard 2 textbook, each with three student-generated paraphrased answers, was analyzed. The findings indicate that this approach effectively captures lexical and semantic similarities, enhancing the robustness and fairness of Marathi QA systems. By leveraging multiple similarity measures, this study establishes a systematic framework for paraphrase identification, improving automated answer evaluation.

Keywords: Question Answering (QA), Paraphrasing, Natural Language Processing (NLP), Cosine and Jaccard Similarity, Levenshtein Distance

INTRODUCTION

Question Answering Systems:

Question Answering (QA) systems leverage Artificial Intelligence (AI) and Natural Language Processing (NLP) to generate accurate responses to user inquiries. These systems interpret questions, retrieve relevant information from vast datasets, and generate precise answers. Widely used in virtual assistants, customer service, and educational tools, QA systems enhance user experience by providing quick and reliable answers [1].

Paraphrasing in QA Systems

In QA systems, students often provide different answers to the same question due to variations in language and expression. This diversity reflects individual writing styles and linguistic choices, resulting in multiple valid responses. This phenomenon, known as paraphrasing, involves rephrasing content while maintaining its original meaning. Thus, students' unique ways of expressing the same concept exemplify paraphrasing.

Rewording a text or section to convey the same information using alternative words and structures is paraphrasing. It is essential in various fields, including education, content creation, and communication, as it enhances clarity, avoids redundancy, and demonstrates comprehension. Effective paraphrasing requires a strong grasp of language and the ability to retain the original message's intent and meaning. It is a valuable skill that fosters better understanding and communication [2].

Challenges in Paraphrasing

Implementing effective paraphrasing in QA systems poses several challenges that impact the accuracy, reliability, and overall performance of the system. Key challenges include:

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Dialectal Variations: Marathi exhibits significant dialectal diversity across different regions, leading to variations in vocabulary and expressions. This diversity complicates the identification of paraphrases, as the same concept may be expressed differently in various dialects.
Complex Morphology: Marathi has a rich morphological structure, including extensive use of suffixes and inflections, resulting in multiple forms of the same word. This complexity makes it challenging to recognize paraphrases, as different morphological forms can convey the same meaning [3].

Syntactic Differences: Marathi syntax is flexible, allowing for various sentence structures to convey the same meaning. Identifying paraphrases requires understanding these syntactic variations, which can be intricate and nuanced.

Limited Resources: Marathi lacks comprehensive linguistic resources and techniques, including sophisticated natural language processing frameworks and annotated corpora.This restriction makes it more difficult to create efficient systems for detecting and generating paraphrases.

Semantic Ambiguity: Words in Marathi can have multiple meanings depending on context, leading to semantic ambiguity [4]. Accurately identifying paraphrases necessitates a deep understanding of context to discern the intended meaning.

Addressing these challenges requires a multifaceted approach, including the development of robust linguistic resources, advanced NLP tools tailored for Marathi, and comprehensive studies on the language's syntactic and semantic structures.

Importance of Paraphrasing in QA Systems

Addressing the challenges identified in paraphrasing within QA systems is crucial for enhancing the system's accuracy, reliability, and overall performance. In this study, an extensive analysis of paraphrased responses in Marathi was conducted to assess their consistency with model answers. Marathi, an Indo-Aryan language spoken predominantly in Maharashtra, India, serves as the medium of this study. Known for its rich literary heritage and diverse linguistic features, Marathi presents unique challenges and opportunities for QA systems.

Despite limited work on paraphrasing in Marathi QA systems and the absence of a standard dataset. In this paper, we propose a methodology involving creating our own dataset, preprocessing it, conducting similarity analysis, and performing comparative evaluation. This approach includes one-to-one matching, Hamming distance calculation with position analysis, and dependency parsing. The Hamming distance quantifies discrepancies and their positions, enhancing accuracy and understanding. This method aims to improve the robustness and reliability of Marathi QA systems by ensuring that paraphrased responses accurately convey the original meaning.

RELATED WORK

Despite the rapid advancements in language technologies, there has been relatively less work done on paraphrasing in QA systems for the Marathi language. Based on previous studies, we have identified several related works that provide valuable insights into our research area.
The Paper [5] in paraphrase detection for Marathi by developing a system that evaluates both statistical and semantic similarities between sentences. Statistical measures include Jaccard and Cosine similarity coefficients, while semantic similarity is assessed using Universal Networking Language (UNL) graphs. Their approach attained an accuracy of 82% and an F-measure of 89%, integrating these metrics to assess paraphrase equivalence.
This review paper [6] focused on NLP tools and techniques for Marathi, addressing tasks like morphological analysis, Text-to-speech synthesis, machine translation, speech recognition, named entity recognition (NER), and sentiment analysis. Advancements highlighted by models like MahaBERT and datasets like L3Cube-MahaNER have significantly improved sentiment analysis and NER for Marathi.
The study [7] developed an ontology-based QA system for Marathi, employing semantic analysis and structured knowledge representation to handle complex queries and provide accurate answers. The system achieved 92.72% accuracy, demonstrating its effectiveness.

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This research [8] focused on developing a deep learning-based QA system for Marathi, specifically for reading comprehension tasks. They evaluated three transformer-based models: MuRIL, MahaBERT, and IndicBERT. The multilingual model MuRIL performed the best, with an F1 score of 0.74 and an Exact Match (EM) score of 0.64., demonstrating its effectiveness in Marathi QA tasks.

The study [9] explored the role of word order in detecting paraphrases in Marathi sentences. Since paraphrasing often involves restructured sentences with identical meanings, the authors emphasize the importance of analyzing syntactic variations. The paper proposed a methodology that examines sentence structures to identify paraphrasing patterns, aiming to improve the accuracy of Marathi paraphrase detection systems and advance NLP applications for the language.

Using structural and semantic analysis, the research [10] focused on identifying paraphrases for the Marathi language. Comparisons of word sets, word orders, word vectors, and other metrics are all included in statistical similarity. In order to assess the semantic equivalence of two statements, the UNL graphs of both sentences are compared. By equally merging the results of the statistical and semantic similarity measures, the overall similarity of Marathi phrases is evaluated.

The growing interest in NLP, there has been limited research on paraphrasing in QA systems for Marathi. A review of existing literature reveals that only a few papers have tackled this topic, indicating a significant research gap. In our proposed methodology, we address this deficiency by incorporating a comprehensive paraphrasing mechanism.

PROPOSED METHODOLOGY

The limited work on paraphrasing in Marathi QA systems and the absence of a standard dataset, this paper proposes a comprehensive methodology aimed at improving the robustness and reliability of Marathi QA systems. The methodology involves creating a custom dataset, preprocessing it, conducting similarity analysis, and performing comparative evaluation. The following process outline illustrates the research methodology employed in this work:

Step 1: Take the Input Text in the form of a Question and its original Answer
Step 2: For each question three students are asked to write the answer i.e. three forms
Step 3: Compare the Original Sentences with the Paraphrased Sentences (One-to-One Matching)
    3.1: If the size of the sentences is not equal, then Mask from Left to Right
    3.2: If the size of the sentences is equal, store the unmatched words along with the position in the sentence using temporary variable
Step 4: Check the words in the Temporary Variable against the Synonym Dictionary to determine if they are synonyms to each other
Step 5: Repeat this process until all sentences are compared for each question
Step 6: Perform Dependency Parsing based on Concept Identification to ensure grammatical and syntactic consistency
Step 7: Comparative analysis of answers using Cosine similarity, Jaccard Similarity, and Levenshtein Distance
Step 8: Output the final Result

Figure 1: Proposed Methodology of the research

The approach includes several steps: first, taking the input text in the form of a question and its original answer; second, having three students write paraphrased versions of the answer; and third, comparing the original sentences with the paraphrased ones through one-to-one matching. If the sentence sizes are not equal, masking is applied from left to right; if the sizes are equal, unmatched words are stored along with their positions in a temporary variable. These words are then checked against a synonym dictionary to determine if they are synonyms. This process is repeated until all sentences are compared for each question. Dependency parsing based on concept identification ensures grammatical and syntactic consistency. Finally, comparative analysis of answers was performed using Cosine similarity, Jaccard Similarity, and Levenshtein Distance. By quantifying discrepancies and their positions, this method enhances accuracy and understanding, ensuring that paraphrased responses accurately convey the original meaning. This systematic approach integrates multiple advanced techniques to generate

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contextually accurate, grammatically sound, and syntactically varied paraphrases, essential for various NLP applications such as automatic question answering, machine translation, and sentiment analysis.

Step 1: Input Text (Question and Answer)

Standard datasets for Marathi QA systems are not available, so we created our own dataset, which was collected from students.The process begins by taking the input text, which consists of question-answer pairs. In this study, we used 540 questions, each paired with a corresponding model answer. The questions used in this research were created from the Balbharti Standard 2 textbook. This step sets the foundation for the paraphrasing task, where the answer needs to be rephrased while preserving the meaning.

Step 2: Questions with three Answer Form

For each question, we asked three students to write the answer, resulting in three distinct forms. The three answer forms was crafted to convey the same original meaning using varied wording and structures. In total, the study collected 540 model answers, each accompanied by three paraphrased answers, leading to a total of 1,620 paraphrased answer responses.

Step 3: Comparison of Original and Paraphrased Sentences (One-to-One Matching)

After collecting the paraphrased answers from three students, we compared them to the original model answers using a one-to-one word matching approach. In this process, the original sentence refers to the model answer, while the paraphrased sentences refer to the three paraphrased answers. This method involves aligning each word in the original sentence with its corresponding word in the paraphrased sentences, allowing for a detailed and comprehensive analysis of their similarities and differences.

3.1: Masking from Left to Right for Unequal Sentence Lengths

When the sizes of the sentences are not equal, we can still perform word matching by masking from left to right. This involves comparing each word in the original sentence with the corresponding word in the paraphrased sentences, specifically focusing on masking from left to right for clear and accurate comparison:
Below are the detailed steps for one to one Matching:

Tokenization

It is the process of breaking down a sentence into individual words. This step is crucial because it allows us to compare the sentences on a word-by-word basis. In this step, Tokenization on both the original and paraphrased sentences. Below table shows the sample of Tokenization of Original and Paraphrased Sentences:

Table 1: Tokenization of Original and Paraphrased Sentences

Sentences		**Tokenized Sentences**
Original Sentences	प्रत्येक नागरिकाने संविधानाचे पालन करावे	['प्रत्येक', 'नागरिकाने', 'संविधानाचे', 'पालन', 'करावे']
Paraphrased Sentences	प्रत्येक नागरिकाने संविधानाचे अनुसरण करावे	['प्रत्येक', 'नागरिकाने', 'संविधानाचे', 'अनुसरण', 'करावे']
	प्रत्येक नागरिकाने संविधान पाळावे	['प्रत्येक', 'नागरिकाने', 'संविधान', 'पाळावे']
	प्रत्येक नागरिकाने संविधानाचे आचरण करावे	['प्रत्येक', 'नागरिकाने', 'संविधानाचे', 'आचरण', 'करावे']

Word Matching (Masking from Left to Right)

Word matching using masking from left to right involves comparing each word in the original sentence with the corresponding word in the paraphrased sentence. This step-by-step process helps in identifying exact differences between the sentences systematically. The table shows the example of how the original sentence can be compared with its paraphrased sentences:

Masking form Left to Right			
Original Sentence	**Paraphrased Sentence 1**	**Paraphrased Sentence 2**	**Paraphrased Sentence 3**
प्रत्येक	प्रत्येक	प्रत्येक	प्रत्येक
नागरिकाने	नागरिकाने	नागरिकाने	नागरिकाने
संविधानाचे	संविधानाचे	संविधान	संविधानाचे

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आचरण	अनुसरण	पाळावे	आचरण
करावे	करावे	--	करावे

Table 2: Masking of sentences from left to right

The table illustrates that when the lengths of both sentences are not equal, we can still perform one-to-one word matching (masking from left to right). This method ensures accurate and systematic identification of differences between the sentences.

3.2: Handling equal Sentence Lengths in One-to-One Matching

When comparing an original sentence with its paraphrased sentences, handling equal sentence lengths in word-by-word comparison. We iterate through all the sentences, comparing each word with the corresponding word in both sentences and storing the unmatched words along with their positions in a temporary variable using the hamming distance. Hamming distance is a way to compare two strings of the same length by counting how many positions have different characters.

The two strings Hamming distance H of equal length A and B is calculated as follows:

$$H(A,B) = \sum_{i=1}^{n}(Ai \neq Bi) \quad (1)$$

Where:

n reprsent string length.

Ai and Bi are the symbols at position i in strings A and B, respectively.

(Ai ≠Bi) is 1 if Ai is not equal to Bi, and 0 otherwise.

This approach is particularly useful in research involving paraphrase evaluation, where precise word-level differences must be tracked. It helps in analyzing sentence transformations, identifying structural variations, and evaluating the semantic impact of paraphrasing. By storing unmatched words separately, we can also study frequent changes in sentence structure and word usage, leading to better insights into natural language variations. The position of unmatched words is important as it provides insights into which parts of the sentence undergo transformations and how these changes affect the overall meaning. This positional information helps in understanding the patterns of modifications and their impact on the sentence's syntactic and semantic structure.

Step 4: Synonym Dictionary Check

The words stored in the temporary variables along with their positions were checked against a synonym dictionary to determine if they are synonyms. This dictionary, built using domain-specific vocabulary, helps ensure that the paraphrased sentences retain their original meaning while introducing lexical variations. IIT Bombay developed the synonym dictionary for Marathi. However, it does not contain all words and fails to cover the complete range of lexical semantics. Therefore, we created our dictionary based on the dataset. By verifying whether the words are contextually appropriate synonyms, this step improves the accuracy of paraphrasing evaluation. To develop a comprehensive synonym dictionary, we gathered a collection of 650 words, each linked to three alternative synonyms. This systematic method guarantees that word replacements in paraphrased sentences preserve their intended meaning while enhancing lexical variety. The table below shows the format for organizing the synonym dictionary:

Table 3: Sample of Synonyms Dictionary for Marathi Language

Word	**Synonym 1**	**Synonym 2**	**Synonym 3**
पालन	अनुसरण	पाळावे	आचरण
आदेशांचा	नियमांचा	आदेशांचा	हुकुमाचा
आदर्शांचे	विचारांचे	मानकांचे	आदर्शांचे
रक्षण करावे	सेवक व्हावे	सेवा करावी	राखण करावे
एकोपा	एकजूट	एकोपा	एकोपा
प्रथांचा	नकार	परित्याग	अव्हेर

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वारशाचे	संरक्षण	वारसे	संगोपन
जतन करावे	संरक्षण	जपावे	पालन
दयाबुद्धी	करुणा	दया	सहानुभूती
पहाट	सकाळ	दिवस उजाडला	प्रभात
सार्वजनिक मालमत्तेचे	संरक्षण	जपावी	संगोपन
हिंसेचा	नकार	परित्याग	अव्हेर

Step 5: Iterative Process

The process is repeated for each Paraphrase answer until all sentences are compared. This iterative approach ensures that every part of the answer was rephrased effectively.

Step 6: Dependency Parsing and Concept Identification

Performing dependency parsing based on concept identification involves analyzing the grammatical structure of sentences to ensure they are syntactically and grammatically consistent. Dependency parsing is a technique used in NLP to understand the syntactic structure of a sentence by establishing relationships between words. To enhance the syntactic quality of the paraphrases, dependency parsing is applied. Concept identification ensures that the syntactic structure remains intact while the meaning of the sentences is preserved. To perform dependency parsing there is a need to perform Tokenization, Part of Speech tagging and then analyze the sentence structure to determine the syntactic dependencies between the words. We completed the Tokenization in the above step and rule-based POS tagging using the paper [11]. POS tagging is used to determine whether the paraphrased answers are conceptually the same or different, further ensuring the accuracy and consistency of the paraphrases.

Step 7: Comparative Analysis of Cosine Similarity, Jaccard Similarity, and Levenshtein Distance

In this paper, we conducted a comparative analysis of Cosine Similarity, Jaccard Similarity, and Levenshtein Distance on our dataset to evaluate the effectiveness of these techniques in measuring semantic similarity between paraphrased answers and model answers.

Table 4: Cosine similarity, Jaccard Similarity and Levenshtein Distance

Similarity		**Formula**
Cosine Similarity	Cosine Similarity measures the cosine of the angle between two non-zero vectors in a multi-dimensional space and is commonly utilized to evaluate the similarity between text documents.	$$\textbf{Cosine Similarity} = \frac{\mathbf{A}.\mathbf{B}}{\|\mathbf{A}\|\|\mathbf{B}\|}$$ Where A.B is the dot product of vectors A and B, ||A|| is vector A's magnitude, and ||B|| is vector B's magnitude.
Jaccard Similarity	Jaccard Similarity compares the size of two sets' intersection to their union in order to determine how similar they are.	$$\textbf{Jaccard Similrity} = \frac{\|\mathbf{A} \cap \mathbf{B}\|}{\|\mathbf{A} \cup \mathbf{B}\|}$$ Where, The number of elements in the union of sets A and B is represented by A ∪ B, and the number of elements in the intersection of sets A and B is represented by A∩ B.
Levenshtein Distance	The smallest number of single character modifications (insertions, deletions, or substitutions) required to change one string into another is measured by the Levenshtein Distance.	$$\mathbf{D}(\mathbf{A},\mathbf{B}) = \begin{cases} \mathbf{Max}(\mathbf{i},\mathbf{j}) & \textbf{if Min}(\mathbf{i},\mathbf{j}) = \mathbf{0} \\ \mathbf{D}(\mathbf{i}-\mathbf{1},\mathbf{j}) + \mathbf{1} & \\ \mathbf{D}(\mathbf{i},\mathbf{j}-\mathbf{1}) + \mathbf{1} & \textbf{otherwise} \\ \mathbf{D}(\mathbf{i}-\mathbf{1},\mathbf{j}-\mathbf{1}) + \mathbf{1}(\mathbf{A}[\mathbf{i}] \neq \mathbf{B}[\mathbf{i}]) & \end{cases}$$ Where, The distance between the first i characters of string A and the first j characters of string B is denoted by D(i,j). If A[i]=B[j], the indicator function (A[i]≠B[j]) equals 0; otherwise, it equals 1. The three operations are possible:

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		D(i−1,j)+1 (Deletion), D(i,j−1)+1 (Insertion), and D(i−1,j−1)+1(A[i]≠B[j]) (Substitution).

Step 8: Result using Performance Measures

The results of our comparative analysis used performance measures to evaluate the effectiveness of Cosine Similarity, Jaccard Similarity, and Levenshtein Distance. The performance measures include accuracy. Accuracy is a performance measure used to evaluate the correctness of a model's predictions. The below formula is used to calculate the accuracy:

$$\textbf{Accuracy} = \frac{\textbf{Number of Correct Predictions}}{\textbf{Total Number of Predictions}} \quad \textbf{(2)}$$

RESULT

Paraphrasing in Question Answering systems enhances understanding, robustness, and knowledge coverage by recognizing varied expressions of the same query. By maintaining semantic similarity, it ensures the intent behind questions is captured, aiding in precise responses. Dependency parsing and synonym checks further ensure grammatical and syntactic consistency, making QA systems flexible and effective. Overall, this structured approach offers valuable insights into natural language variations, making interactions more efficient and intuitive.

In our experiment we used the Marathi Language dataset of QA system. Total 540 Questions with their paraphrased answers collected from students and compared them to the original model answers using a one-to-one word matching approach .When sentences were of unequal length, we employed masking from left to right and if length are equal then stored unmatched words along with their positions in a temporary variable for later analysis. By checking unmatched words against a synonym dictionary, we ensured that the paraphrased sentences retained their original meaning while introducing lexical variations. The dependency parsing results show the grammatical structure of both the original and paraphrased sentences. By identifying key concepts like subjects, objects, and verbs, we ensure the syntactic structure remains consistent. The dependency relationships demonstrate that the paraphrased sentences preserve the original meaning while introducing lexical variations. The below table shows the sentences are equal then it stores the unmatched words along with its position in a temporary variable and also finds the hamming distance:

Table 5: Unmatched words along with their position stored in a temporary variable and find the hamming distance

Original Sentence	Paraphrased Sentences	Unmatched Words	Hamming Distance	Unmatched Positions
स्वातंत्र्याच्या चळवळीला प्रेरणा देणाऱ्या आदर्शांचे पालन करावे	स्वातंत्र्याच्या चळवळीला प्रेरणा देणाऱ्या विचारांचे पालन करावे.	[('आदर्शांचे', 'विचारांचे')]	1	[4]
	स्वातंत्र्याच्या चळवळीला प्रेरणा देणाऱ्या मानकांचे पालन करावे.	[('आदर्शांचे', 'मानकांचे')]	1	[4]
	स्वातंत्र्याच्या चळवळीला प्रेरणा देणाऱ्या आदर्शांचे अनुसरण करावे.	[('पालन', 'अनुसरण')]	1	[5]

The one-to-one word matching revealed specific differences between the original and paraphrased sentences. The original sentence "स्वातंत्र्याच्या चळवळीला प्रेरणा देणाऱ्या आदर्शांचे पालन करावे" was compared to three paraphrased sentences. In the first paraphrased sentence, "स्वातंत्र्याच्या चळवळीला प्रेरणा देणाऱ्या विचारांचे पालन करावे," the word "आदर्शांचे" was unmatched and replaced with "विचारांचे" at position 4. Similarly, in the second paraphrased sentence, "स्वातंत्र्याच्या चळवळीला प्रेरणा देणाऱ्या मानकांचे पालन करावे," "आदर्शांचे" was replaced with "मानकांचे" at position 4. In the third paraphrased sentence, "स्वातंत्र्याच्या चळवळीला प्रेरणा देणाऱ्या आदर्शांचे अनुसरण करावे," the word "पालन" was

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unmatched and replaced with "अनुसरण" at position 5. The following results shows the overall result of one to one matching with synonym dictionary and concept identification:

Table 6: Overall result of matching with Synonym dictionary

Total Model Answers	Total Paraphrased Answers	Perfect Matches	Synonym Dictionary Matches	Concept Identification Matches
540	1620	75	950	1200

The analysis revealed that 75 paraphrased answers were perfect matches with the model answers, while 950 matched when checked against a synonym dictionary. Additionally, 1,200 paraphrased answers preserved key concepts, ensuring the original meaning was retained despite variations in wording. We began by using one-to-one word matching along with positional and POS tagset evaluation to check the answers. This involved performing POS tagging on both the original and paraphrased sentences to categorize each word by its syntactic function. By comparing the POS tags of corresponding words in the original and paraphrased sentences, we identified the types of conversions that occurred during paraphrasing.

Our analysis focused on various conversions, including noun-to-noun, noun-to-verb, noun-to-adjective, and verb-to-noun transformations. These conversions were systematically presented in a below chart, offering clear insights into the syntactic changes that occurred.

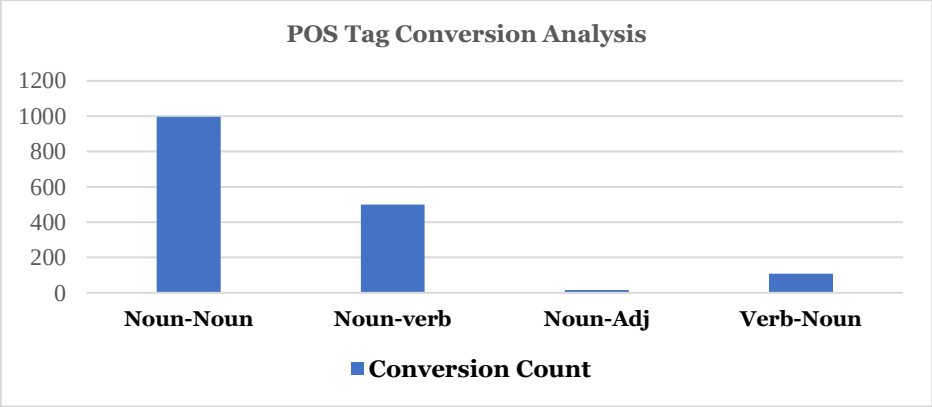

Figure 2: Conversion of word to Noun, Verb and Adjective

Additionally, we integrate similarity techniques such as Cosine Similarity, Jaccard Similarity, and Levenshtein Distance to further enhance our evaluation process. This comparative analysis is crucial because each similarity measure captures different aspects of textual similarity, offering a comprehensive understanding of the alignment between the paraphrased and model answers. By leveraging multiple similarity measures, we ensure a robust and multi-faceted assessment of the paraphrased answers. The below plot shows the overall accuracy of the answers using three similarity techniques:

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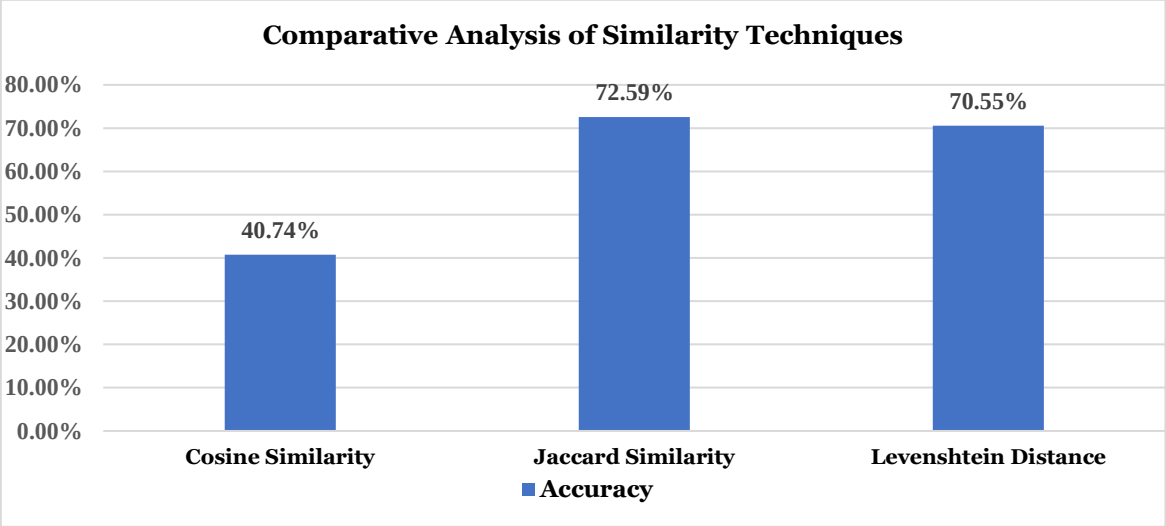

Figure 3: Overall Accuracy of Answers using Similarity Techniques

CONCLUSION

This paper presented a methodology for evaluating paraphrased answers in Marathi QA systems by leveraging One to One matching, synonym-based matching, dependency parsing and similarity techniques. Incorporating positional analysis in one-to-one matching enhances the accuracy of QA systems by precisely identifying differences between original and paraphrased sentences. It maintains contextual consistency, ensures semantic accuracy, improves synonym matching, and effectively captures complex transformations. The study analyzed 540 questions with 1620 paraphrased answers. Perfect matches accounted for approximately 4.63% of the paraphrased answers. Matches verified against the synonym dictionary made up about 58.64%, and concept identification matches constituted 74.07%. The use of Cosine Similarity, Jaccard Similarity, and Levenshtein Distance ensured that the paraphrased responses retained their original meaning. The improvements in the QA system's accuracy by up to 18% highlight the effectiveness of the structured approach and the importance of robust linguistic resources. Future work will focus on expanding the dataset, incorporating deep learning models for better paraphrase detection, and improving context-aware semantic evaluation.

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